EE 200: Problem Set 2

1. Define the energy and average power of the following analog signals:

   (a) $y_1(t) = \begin{cases} 0.5, & -1 \leq t \leq 1 \\ 0, & \text{otherwise} \end{cases}$

   (b) $y_2(t) = \begin{cases} t, & t \geq 0 \\ 0, & \text{otherwise} \end{cases}$

   (c) $y_3(t) = e^{-2t}u(t)$

   (d) $y_4(t) = 3\sin(0.5\pi t + 0.4)$

2. Determine the average power of the analog signal:
   $x(t) = A_1 \sin(\Omega_1 t) + A_2 \sin(\Omega_2 t), \Omega_1 \neq \Omega_2$

3. Show that

   (a) $(t - T)\delta(t - T) = 0$

   (b) $\cos(t)\delta(t + \pi) = -\delta(t + \pi)$

   (c) $\cos(t)\delta(t + \pi/2) = 0$

4. Evaluate the following definite integrals:

   (a) $\int_{-\infty}^{t} \sin(\tau)\delta(\tau)d\tau$

   (b) $\int_{-\infty}^{t} \sin(\tau)\mu(\tau)d\tau$

   (c) $\int_{-\infty}^{\infty} \sin(\tau)\delta(\tau)\mu(\tau - 2)d\tau$

   (d) $\int_{-\infty}^{\infty} \tau\cos(\tau/2)\delta(\tau - \pi)d\tau$

5. Develop a differential equation representation relating the analog signals $y(t)$ and $x(t)$ of the following equation:

$$3y(t) = 2\int_{-\infty}^{t} x(\tau)d\tau - 5x(t) + 9\int_{-\infty}^{t} y(\tau)d\tau$$

6. Develop a differential equation representation relating the analog signals $y(t)$ and $x(t)$ of the following two equations:

$$2w(t) = 8x(t) - 7\int_{-\infty}^{t} x(\tau)d\tau + 3\int_{-\infty}^{t}\left[\int_{-\infty}^{\tau} x(\xi)d\xi\right]d\tau,$$

$$5y(t) = 4w(t) + 6\int_{-\infty}^{t} y(\tau)d\tau - 10\int_{-\infty}^{t}\left[\int_{-\infty}^{\tau} y(\xi)d\xi\right]d\tau,$$

7. Write a MATLAB program to generate and plot the sinusoidal signal

$$\tilde{y}(t) = 7.5\cos(0.6\pi t + \frac{\pi}{3})$$

8. Write a MATLAB program to generate and plot the exponential signals of slide 31, Ch3-1 (Notes).